CHAPTER 5 GREENHOUSE GAS EMISSIONS AND CLIMATE CHANGE IN WASHINGTON STATE

Consensus is growing in the scientific community that global average temperatures have increased over the last century, with particularly marked increases in the last decade. Scientists have linked these changes to increasing concentrations of greenhouse gases (carbon dioxide, methane, and other gases) resulting from human activities, principally the production and consumption of fossil fuels.

This chapter briefly discusses the possible consequences of global climate change on Washington and the Pacific Northwest, the current scientific basis for climate change, greenhouse gas emissions in the state, and some of the efforts underway both in Washington and other states to reduce greenhouse gas emissions.

Potential Impacts of Climate Change on the Pacific Northwest

What are the likely consequences of global climate change on the state and region? The University of Washington's Joint Institute for the Study of Atmosphere and Ocean (JISAO) completed a study entitled *The Impacts of Climate Variability and Change in the Pacific Northwest*[1] that examined this question.

The JISAO group concluded that "computer models of climate generally agree that the Pacific Northwest will become, over the next half century, gradually warmer and wetter, with most of the precipitation increase in the winter."[2] Among the likely results of such weather pattern changes will be increases in winter flooding and landslides, loss of snow-pack, and more water stress during the summer months.

From an energy perspective, the impacts of climate change on hydrology and hydroelectric generation are likely to be significant. The study concludes that "warmer, wetter winters and hotter summers will reduce winter snowpack, increase winter runoff and flooding, change the spring freshet for migrating juvenile salmon, and reduce summer water supply and water quality."[3] Both the Northwest and Washington State are highly dependent on winter snowpack for water storage. Declining storage will mean less water available for the already competing uses of fish, hydroelectricity, irrigation, municipal and industrial water supply, and recreation. Current demand for low cost Columbia/Snake River generated electricity already outstrips supply. Change in the timing and decreases in the availability of snowmelt could lead to further significant declines in this supply.

Climate Science - Increasing Scientific Consensus

Scientific investigation of global climate change is a coordinated effort by the Intergovernmental Panel on Climate Change (IPCC). The World Meteorological Organization and the United Nations established the IPCC in 1988 as a response to growing concerns about human caused climate change. The IPCC role is to "(i) assess available scientific information on climate change, (ii) assess the environmental and socio-economic impacts of climate change, and (iii) formulate response strategies"[4] The Panel's oft quoted 1995 conclusion about man-made greenhouse gas emissions and global climate change was that "the balance of evidence suggests a discernable human influence on global climate," and that such influence was likely to result in a 1 to 3.5 degree centigrade increase in global average temperatures by 2001.

An updated version of the 1995 report will be published in 2001. A draft of this update was issued in October 2000 for governmental review. Robert Watson, Chair of the IPCC, presented a summary on the current state of knowledge on climate change at the recently concluded climate meeting in The Hague.[5] Watson underscored the basic conclusions of the IPCC, "[t]he overwhelming majority of scien-

tific experts, whilst recognizing that scientific uncertainties exist, nonetheless, believe that human-induced climate change is inevitable." He further noted that global mean surface temperatures are projected to increase by about 1.5 to 6.0°C (2.7 to 10.8°F), nearly a doubling of the estimates made in 1995. The higher temperature projections result from new analyses indicating that air pollution control efforts will decrease atmospheric aerosols, which create an atmospheric cooling effect. Such warming, if unchecked, would be at a rate unprecedented in the last 10,000 years.

Greenhouse Gas Emissions in Washington State

Carbon dioxide emissions from energy use are determined by the quantity of fossil fuels consumed and their carbon content. Figure 18 shows carbon dioxide emissions by end use sector since 1960[6]. Emissions are calculated for each fossil fuel consumed or sold in the state. The building sector includes the residential and commercial sectors while the electricity sector includes utility and non-utility emissions. Emissions for 2000 are annualized emissions based on preliminary reports through August 2000. Washington's emissions profile differs from the national average because our traditional source of electricity was hydroelectricity. This results in the transportation sector being responsible for most of the emissions. On a relative basis, transportation emissions have risen from 42% of the total in 1960, peaked in 1995, and have declined slightly in the late 1990's. However, on an absolute basis emissions, are increasing in all sectors.

Figure 18 dramatically shows the influence of changes in fuel use. The emissions from the generation of electricity increased dramatically in 1972 when the Centralia (now TransAlta) power plant came on line and began consuming large quantities of coal. Since the mid-1990's utilities and non-utility companies have begun using natural gas in combustion turbines to supply growing demand for electricity. Carbon dioxide emissions from the electricity sector are now greater than those from fossil fuel use in the industrial or buildings sectors. Emissions from the electric sector are estimated to be at a record high of 17 million tons of carbon dioxide in 2000. If all the power plants that are currently proposed came on line an additional 18.5 million tons would be emitted.[7] Figure 24, in Chapter 6, charts CO_2 emissions by type of fuel rather than end use. Over 75% of CO_2 emissions are from petrol-eum consumption, primarily for transportation.

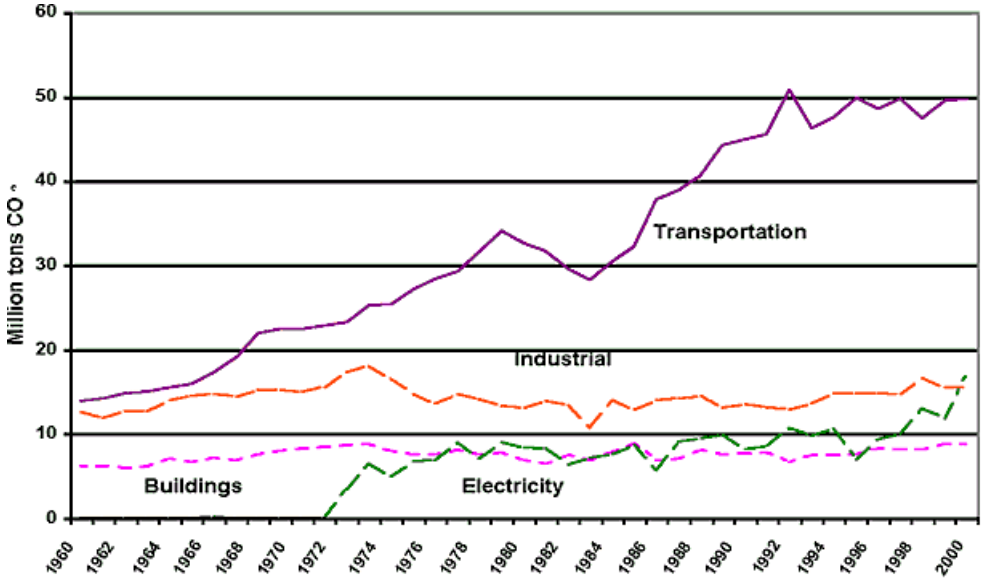

Figure 18 CO_2 Emissions from Fossil Fuel Consumption

Source Energy Information Administration Data

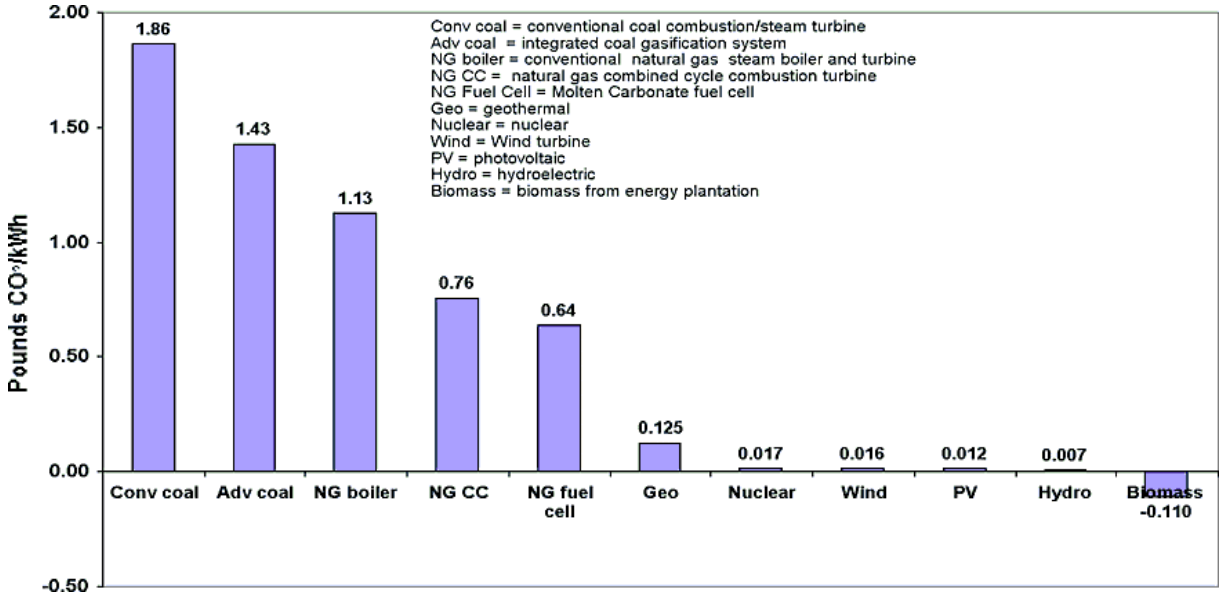

Figure 19 CO_2 Emissions by Electric Generating Technology and Fuel Source

Source: Energy Information Administration, Department of Energy

Emissions from electric generating facilities depend on both the technology and the fuel choice. The technology determines the efficiency of converting the fuel into electricity and the fuel determines the carbon content. Figure 19 illustrates the wide range of carbon dioxide emissions from electric generation[8]. The renewable and nuclear options have no net emissions from fuel use and are an order of magnitude lower than emissions from fossil generation. The small quantities shown account for the emissions resulting from the materials used to construct the facilities. The biomass emissions are shown as negative based on the assumption that energy plantations would provide the fuel and that they result in a net sequestration (storage) of carbon dioxide.

Carbon Sinks

Most discussion on greenhouse gases deal with emissions. The Kyoto protocol recognized that carbon dioxide concentrations in the atmosphere were the critical factor in driving climate change. The global carbon cycle is characterized by large natural fluxes into and out of oceans and vegetation. These fluxes result in a small net sink that partly compensates for fossil fuel emissions. The Kyoto protocol suggests that management of natural terrestrial carbon sinks, primarily afforestation[9] and reforestation at a global scale, can increase sink strength and thus reduce atmospheric carbon dioxide concentrations.

There are many unanswered questions concerning the accounting for carbon sinks. One of these questions is how do we actually measure the quantity of carbon sequestered and another question is how long the carbon will be kept out of the atmosphere. The advocates of carbon sequestration point out that it is often one of the lowest cost options for reducing net emissions and it may result in more sustainable management of our forest and agricultural lands. This issue is currently being discussed in international negotiations. The Washington legislature has considered several bills dealing with carbon sequestration over the last few years.[10] Their intent was to develop a Washington State carbon sequestration implementation and certification plan. So far, no bill has been sent to the Governor.

State Policy Actions and Options for Greenhouse Gas Reduction

Most of the discussions of climate change, greenhouse gas reduction, and response have centered on national and international actions. Will the U.S. Senate ratify the Kyoto climate accord? How should an international carbon trading program function? What are the appropriate obligations of developing nations?

Yet, many of the most innovative and effective greenhouse gas reduction and climate response actions are occurring at the state level. This section describes some of the activities underway in Washington and other states.

Washington's Response

Washington State has few specific policies or programs in place at the state level to address climate change or greenhouse gas mitigation. Efforts in the 1999 and 2000 legislative sessions to pass legislation that would set up task forces to investigate climate change impacts on Washington State, encourage carbon storage (sequestration), or support greenhouse gas reduction efforts were all unsuccessful.[11] Nonetheless, there are a number of policy, education, and program activities underway throughout the state to decrease greenhouse gas emissions.

Three Washington cities (Seattle, Burien, and Olympia) are members of the International Council for Local Environmental Initiatives (ICLEI) Cities for Climate Protection's Campaign. One example of what these Washington cities are doing is Seattle's ambitious attempt to cut greenhouse gas emissions. In April 2000, Seattle adopted a resolution that established " a long-range goal of meeting the electric energy needs of Seattle with no net greenhouse gas emissions."[12] In order to implement this resolution Seattle City Light has issued a request for proposal for 100 average megawatts of new generating resources from renewable, non-carbon sources (biomass, geothermal, hydro-electric, solar, landfill, and wastewater treatment gas, or wind generation). This is one of the largest efforts to bring on new renewable energy resources by any utility in the Northwest. Seattle expects to have contracts in place for these resources in early 2001.

Many prominent Washington companies have joined voluntary national efforts to improve energy efficiency, increase environmental quality, and reduce their greenhouse gas emissions. Boeing, Starbucks Coffee, and Associated Grocers are among more than 30 Washington-based companies that are members of EPA's Climate Wise Program.[13] Each of these companies has developed action plans and implemented measures to reduce their energy use and consequently, their greenhouse gas emissions. In addition, Boeing, Weyerhaeuser, DuPont, Enron, Shell, and 17 other multinational corporations are members of the Pew Center's Business Environmental Leadership Council. Membership in the Council includes recognition that "the views of most scientists that enough is known about the science and environmental impacts of climate change for us to take actions to address its consequences." And, further, that "We can make significant progress in addressing climate change and sustaining economic growth in the United States by adopting reasonable policies, programs and transition strategies."[14]

Several Washington State-based nonprofit organizations are actively involved in efforts to increase awareness of global climate change, its impacts on the Northwest, and ways to reduce greenhouse gas emissions. The Northwest Council for Climate Change, working in conjunction with Washington State University, OTED, and Climate Solutions, recently completed a series of presentations to local governments, chambers of commerce, and civic organizations throughout the state focusing on climate change in the Northwest. Climate Solutions, an Olympia-based nonprofit works with government, businesses, and trade associations on ways to encourage clean energy development (renewable energy and energy conservation) that decreases greenhouse gas emissions while generating new or expanded opportunities for economic development.[15]

Finally, on December 5, 2000, the Energy Facility Site Evaluation Council (EFSEC) issued an initial order that would require the proposed 520-megawatt Chehalis Generating Station to offset a portion of its lifetime CO_2 emissions.[16] The amended site certification agreement would require Chehalis power to develop a plan to offset greenhouse gas emissions from the plant. Chehalis' offsets must be based on the Oregon Carbon Dioxide Emission Standard (see next section) which is equivalent to an approximately 17% reduction in lifetime CO_2 emissions from the plant. Chehalis would be required to make payments to EFSEC, over a five-year period, to fund the offset projects.[17] As of the publication of this report, the initial order had not been finalized and sent to the governor for his approval, denial, or remand.

Policies and Actions in Other States

There are numerous ways that other states have directed policies and actions toward greenhouse gas reductions. Below are a few representative examples of greenhouse gas reduction planning and target setting, state tax incentives, electric utility support for public purposes (conservation, and renewable energy development), and greenhouse gas reduction standards for new electric generating facilities.

Statewide Greenhouse Gas Reduction Goal Setting

Several states have established goals for overall reduction in greenhouse gas emissions. One of the more recent and ambitious efforts is New Jersey's Sustainability Greenhouse Gas Action Plan.[18] New Jersey's greenhouse gas efforts are part of a larger effort by the state to pursue policies that support sustainability as required under Executive Order 96.[19] New Jersey's focus on global warming and greenhouse gas reductions come from growing concerns about the impacts of sea level rise on the state's environment and economy.

New Jersey's greenhouse gas action plan focuses on five categories of mitigation: 1) energy conservation, 2) innovative technologies, 3) pollution prevention, 4) waste management (municipal solid waste landfill gas recycling), and 5) natural resources-open space. The goal of the plan is to reduce CO_2-equivalent emissions by 20.4 million tons by 2005 - a 3.5 % reduction from 1990 levels.

Tax Incentives

The State of Maryland has recently instituted a wide range of tax incentives to encourage energy efficiency and development of renewable resources

The Maryland Clean Energy Incentive Act, which went into effect on July 1, 2000, provides Maryland sales tax exemptions when purchasing qualifying high efficiency Energy Star appliances, electric and hybrid-electric vehicles, and certain renewable resource energy systems.[20] Solar heating and photovoltaic systems along with electric and hybrid vehicles qualify for significant income tax or excise tax credits.

Public Benefits from the Electricity Sector

Nearly half of the states have introduced some form of electric industry restructuring. Many of those states have recognized the continuing societal benefits of investments in energy efficiency and renewable energy development while also acknowledging that a more open and competitive electricity industry structure may not provide sufficient support for these common public goods. States have responded to this discontinuity by instituting a variety of support mechanisms for conservation and renewables including systems benefit charges and renewable portfolio standards.

California recently reauthorized its Systems Benefit Charge (SBC) through 2011 (SB 1194, passed in September 2000). The extension of the SBC provides for continued funding of cost-effective energy efficiency and conservation, public interest research and development, and support for existing, new, and emerging renewable energy technologies. Funding for these efforts is derived from a 3% assessment on retail electricity sales from investor-owned

utilities. Although California public benefits programs were not primarily designed to reduce greenhouse gas emissions, significant reductions are a likely consequence.

In the Northwest, the Northwest Power Planning Council (NWPPC) convened a regional technical forum (RTF) to establish eligibility standards for Bonneville Power Administration's conservation and renewable energy discount program. The RTF concluded "there is at the very least a risk that serious damage will result from continued increases in greenhouse gas concentrations in the atmosphere." Consequently, they assigned a $15 per ton of CO_2 benefit to be added to the avoided cost calculation for new electricity generation, thus increasing the value of both electricity conservation and generation of electricity from renewable sources.[21]

Regulation of Power Plant Emissions of CO_2

Two other states impose regulations requiring developers of new electric generating plants to offset a portion of the CO_2 emissions from those facilities. Since 1993, the state of Mas-sachusetts, through its Energy Facility Siting board, has required new power plants to offset from 1% to 3% of the plant's total CO_2 emissions at a rate of $1.50 per ton of CO_2. Massachusetts estimates that plants nearing completion will generate approximately $3 million to fund cost effective CO_2 mitigation projects (most likely reforestation efforts)[22]

Oregon has the most stringent requirement for greenhouse gas reductions for newly sited power facilities.[23] The Oregon statute requires that all new baseload natural gas-fired combustion turbines must offset their carbon dioxide emissions to a level of 0.675 lbs. CO_2/killowatt hour. In effect, this standard requires plants to offset their greenhouse gas emissions by 17%. Since there is no cost-effective method to remove carbon dioxide from the plant's stacks, this requirement is met by a combination of greenhouse gas reductions through energy conservation and carbon storage (sequestration) through forestry and agricultural practices. In addition, Oregon has created the Climate Trust as a recipient of mitigation funds. Oregon has sited three new generating facilities that have met this requirement.

Conclusion

There is significant scientific agreement that human-induced climate change is a real phenomenon. Unchecked climate change could have important negative consequences for the Northwest and Washington State. Fortunately, there are many actions and policies available to states that can decrease greenhouse gas emissions while maintaining or even enhancing environmental quality and economic well being.

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1 JISAO Climate Impacts Group, University of Washington, *The Impacts of Climate Variability and Change in the Pacific Northwest,* November 1999.

2 IBID, Overview.

3 IBID, p 44.

4 Houghton, J. T. (ed.) *Climate Change 1995, The Science of Climate Change,* Cambridge Press, 1996, Forward.

5 Presentation of Robert T. Watson, Chair, Intergovernmental Panel on Climate Change, at the Sixth Conference of the Parties to the United Nations Framework on Climate Change, November 13, 2000.

6 *U.S. Energy Information Administration (EIA), State Energy Data Report 1997 for 1960-1997, for 1998-2000,* various EIA Annual and monthly reports.

7 From WIEB showing 5,800MW of new natural gas generation and assuming a 90% capacity factor and 0.81 lb. CO_2/kWh.

8 EIA *Annual Energy Outlook 1999 and US Department of Energy, Environmental Emissions from Energy Technology Systems: The Total Fuel Cycle,* 1989.

9 IPCC defines afforestation as" planting of new forests on lands which, historically, have not contained forests" and reforestation as "planting of forests on lands which have, historically, previously contained forests but which have been converted to some other use".

10 For example, SB5121, Establishing a Carbon Storage Program, 2000.

11 For example, SB 2518, Creating a Joint Select Committee on Climate Change, 2000/

12 City of Seattle, Resolution 30144, April 3, 2000.

13 See http://www.ci.seattle.wa.us/light/conserve/business/cv5_cw.htm for information on what these companies have accomplished and what additional actions they plan to undertake.

14 http://www.pewclimate.org/belc/index.cfm, November 12, 2000.

[15] See for example Patrick Mazza, *Accelerating the Clean Energy Revolution: How the Northwest Can Lead,* Climate Solutions, April 2000.

[16] EFSEC, Council Order No. 752, *Findings of Fact, Conclusions of Law, and Initial Order Granting Amendments on Condition,* December 5, 2000.

[17] Energy Facility Site Evaluation Council, Draft Amended Site Certification Agreement Between the State of Washington and the Chehalis Power Generating, Limited Partnership for the Chehalis Generation Facility, as amended by Amendment No. 1, December 5, 2000.

[18] New Jersey Department of Environmental Protection, *Sustainable Greenhouse Action Plan,* December 1999.

[19] IBID, Appendix A.

[20] "The Maryland Clean Energy Incentive Act" more information is available at http://www.energy.state.md.us/incentive.htm.

[21] Northwest Power Planning Council, RTF Final Recommendations to the Bonneville Power Administration on the Conservation and Renewable Discount - August 21, 2000

[22] Sonia Hamel, "CO_2 Mitigation in the Siting of Power Plants," presentation at the EPA 4th State and Local Climate Change Partner's Conference, Arlington, VA, November 3, 2000.

[23] Oregon Revised Statutes (ORS) 345-024-0500 Standards for Energy Facilities That Emit Carbon Dioxide.